

# 74AUP2G80

Low-power dual D-type flip-flop; positive-edge trigger

Rev. 04 — 2 June 2008

Product data sheet

## 1. General description

The 74AUP2G80 provides the dual positive-edge triggered D-type flip-flop. Information on the data input is transferred to the  $\bar{Q}$  output on the LOW-to-HIGH transition of the clock pulse. The input pin D must be stable one setup time prior to the LOW-to-HIGH clock transition for predictable operation.

Schmitt-trigger action at all inputs makes the circuit tolerant to slower input rise and fall times across the entire  $V_{CC}$  range from 0.8 V to 3.6 V.

This device ensures a very low static and dynamic power consumption across the entire  $V_{CC}$  range from 0.8 V to 3.6 V.

This device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing a damaging backflow current through the device when it is powered down.

## 2. Features

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
  - ◆ JESD8-12 (0.8 V to 1.3 V)
  - ◆ JESD8-11 (0.9 V to 1.65 V)
  - ◆ JESD8-7 (1.2 V to 1.95 V)
  - ◆ JESD8-5 (1.8 V to 2.7 V)
  - ◆ JESD8-B (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114E Class 3A exceeds 5000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101C exceeds 1000 V
- Low static power consumption;  $I_{CC} = 0.9 \mu\text{A}$  (maximum)
- Latch-up performance exceeds 100 mA per JESD78 Class II
- Inputs accept voltages up to 3.6 V
- Low noise overshoot and undershoot < 10 % of  $V_{CC}$
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

### 3. Ordering information

Table 1. Ordering information

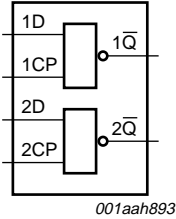
| Type number | Package           |        |  | Version  |
|-------------|-------------------|--------|--|----------|
|             | Temperature range | Name   | Description  |          |
| 74AUP2G80DC | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm                           | SOT765-1 |
| 74AUP2G80GT | -40 °C to +125 °C | XSON8  | plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm          | SOT833-1 |
| 74AUP2G80GD | -40 °C to +125 °C | XSON8U | plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body 3 × 2 × 0.5 mm | SOT996-2 |
| 74AUP2G80GM | -40 °C to +125 °C | XQFN8U | plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 × 1.6 × 0.5 mm | SOT902-1 |

### 4. Marking

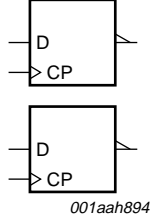
Table 2. Marking codes

| Type number | Marking code |
|-------------|--------------|
| 74AUP2G80DC | p80          |
| 74AUP2G80GT | p80          |
| 74AUP2G80GD | p80          |
| 74AUP2G80GM | p80          |

### 5. Functional diagram



**Fig 1. Logic symbol**



**Fig 2. IEC logic symbol**

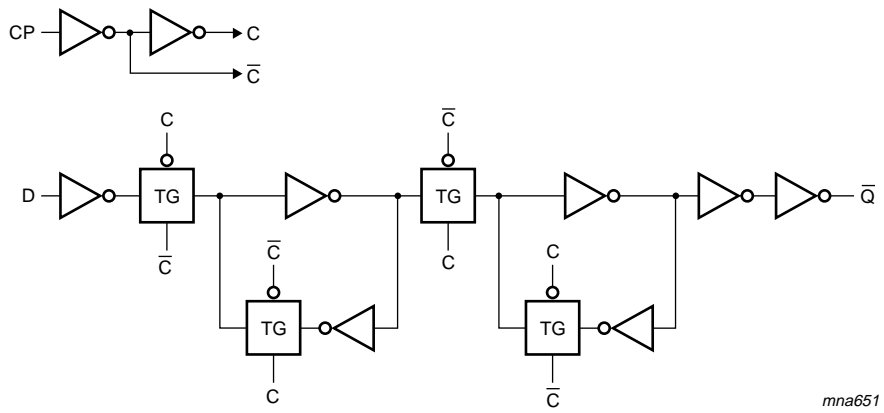


Fig 3. Logic diagram (one flip-flop)

## 6. Pinning information

### 6.1 Pinning

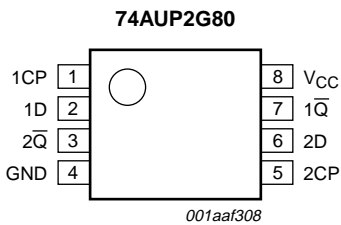


Fig 4. Pin configuration SOT765-1 (VSSOP8)

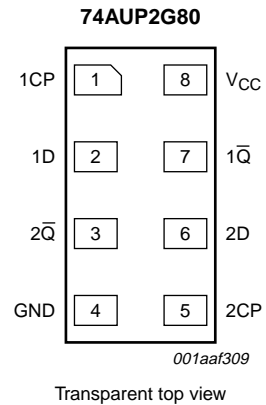
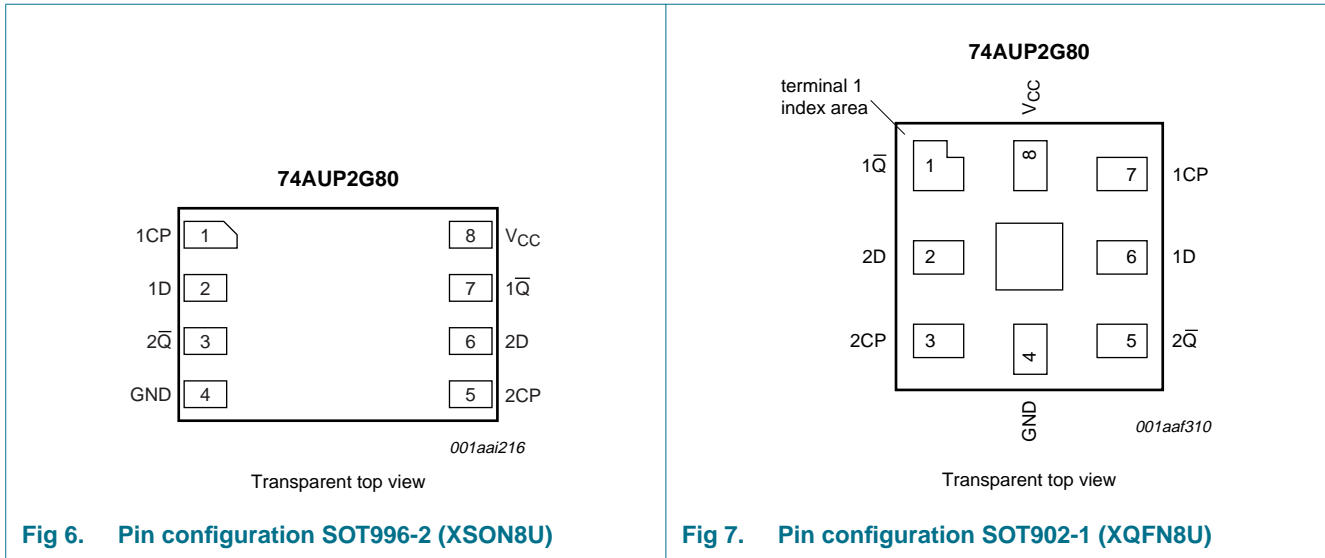


Fig 5. Pin configuration SOT833-1 (XSON8)



6.2 Pin description

Table 3. Pin description

| Symbol          | Pin                             |          | Description    |
|-----------------|---------------------------------|----------|----------------|
|                 | SOT765-1, SOT833-1 and SOT996-2 | SOT902-1 |                |
| 1CP, 2CP        | 1, 5                            | 7, 3     | clock input    |
| 1D, 2D          | 2, 6                            | 6, 2     | data input     |
| GND             | 4                               | 4        | ground (0 V)   |
| 1Q, 2Q          | 7, 3                            | 1, 5     | data output    |
| V <sub>CC</sub> | 8                               | 8        | supply voltage |

7. Functional description

Table 4. Function table<sup>[1]</sup>

| Input |    | Output    |
|-------|----|-----------|
| nCP   | nD | nQ        |
| ↑     | L  | H         |
| ↑     | H  | L         |
| L     | X  | $\bar{q}$ |

[1] H = HIGH voltage level;  
 L = LOW voltage level;  
 ↑ = LOW-to-HIGH CP transition;  
 X = don't care;  
 $\bar{q}$  = lower case letter indicates the state of referenced input, one setup time prior to the LOW-to-HIGH CP transition.

## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol    | Parameter               | Conditions                      | Min      | Max      | Unit |
|-----------|-------------------------|---------------------------------|----------|----------|------|
| $V_{CC}$  | supply voltage          |                                 | -0.5     | +4.6     | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ V                     | -50      | -        | mA   |
| $V_I$     | input voltage           |                                 | [1] -0.5 | +4.6     | V    |
| $I_{OK}$  | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V   | -        | $\pm 50$ | mA   |
| $V_O$     | output voltage          | Active mode and Power-down mode | [1] -0.5 | +4.6     | V    |
| $I_O$     | output current          | $V_O = 0$ V to $V_{CC}$         | -        | $\pm 20$ | mA   |
| $I_{CC}$  | supply current          |                                 | -        | +50      | mA   |
| $I_{GND}$ | ground current          |                                 | -50      | -        | mA   |
| $T_{stg}$ | storage temperature     |                                 | -65      | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C   | [2] -    | 250      | mW   |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For VSSOP8 packages: above 110 °C the value of  $P_{tot}$  derates linearly with 8.0 mW/K.

For XSON8, XSON8U and XQFN8U packages: above 45 °C the value of  $P_{tot}$  derates linearly with 2.4 mW/K.

## 9. Recommended operating conditions

**Table 6. Operating conditions**

| Symbol              | Parameter                           | Conditions                      | Min | Max      | Unit |
|---------------------|-------------------------------------|---------------------------------|-----|----------|------|
| $V_{CC}$            | supply voltage                      |                                 | 0.8 | 3.6      | V    |
| $V_I$               | input voltage                       |                                 | 0   | 3.6      | V    |
| $V_O$               | output voltage                      | Active mode                     | 0   | $V_{CC}$ | V    |
|                     |                                     | Power-down mode; $V_{CC} = 0$ V | 0   | 3.6      | V    |
| $T_{amb}$           | ambient temperature                 |                                 | -40 | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 0.8$ V to 3.6 V       | -   | 200      | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol                         | Parameter  | Conditions   | Min                    | Typ  | Max                    | Unit |
|--------------------------------|--|--|------------------------|------|------------------------|------|
| <b>T<sub>amb</sub> = 25 °C</b> |  |  |                        |      |                        |      |
| V <sub>IH</sub>                | HIGH-level input voltage                         | V <sub>CC</sub> = 0.8 V  | 0.70 × V <sub>CC</sub> | -    | -                      | V    |
|                                |  | V <sub>CC</sub> = 0.9 V to 1.95 V  | 0.65 × V <sub>CC</sub> | -    | -                      | V    |
|                                |  | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.6                    | -    | -                      | V    |
|                                |  | V <sub>CC</sub> = 3.0 V to 3.6 V   | 2.0                    | -    | -                      | V    |
| V <sub>IL</sub>                | LOW-level input voltage                          | V <sub>CC</sub> = 0.8 V  | -                      | -    | 0.30 × V <sub>CC</sub> | V    |
|                                |  | V <sub>CC</sub> = 0.9 V to 1.95 V  | -                      | -    | 0.35 × V <sub>CC</sub> | V    |
|                                |  | V <sub>CC</sub> = 2.3 V to 2.7 V   | -                      | -    | 0.7                    | V    |
|                                |  | V <sub>CC</sub> = 3.0 V to 3.6 V   | -                      | -    | 0.9                    | V    |
| V <sub>OH</sub>                | HIGH-level output voltage                        | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |      |                        |      |
|                                |  | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V  | V <sub>CC</sub> - 0.1  | -    | -                      | V    |
|                                |  | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.75 × V <sub>CC</sub> | -    | -                      | V    |
|                                |  | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 1.11                   | -    | -                      | V    |
|                                |  | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.32                   | -    | -                      | V    |
|                                |  | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V  | 2.05                   | -    | -                      | V    |
|                                |  | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V  | 1.9                    | -    | -                      | V    |
|                                |  | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V  | 2.72                   | -    | -                      | V    |
| V <sub>OL</sub>                | LOW-level output voltage                         | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |      |                        |      |
|                                |  | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V   | -                      | -    | 0.1                    | V    |
|                                |  | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V   | -                      | -    | 0.3 × V <sub>CC</sub>  | V    |
|                                |  | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V   | -                      | -    | 0.31                   | V    |
|                                |  | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V  | -                      | -    | 0.31                   | V    |
|                                |  | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V   | -                      | -    | 0.31                   | V    |
|                                |  | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V   | -                      | -    | 0.44                   | V    |
|                                |  | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V   | -                      | -    | 0.31                   | V    |
|                                | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V | -  | -                      | 0.44 | V                      |      |
| I <sub>I</sub>                 | input leakage current                            | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                    | -                      | -    | ±0.1                   | μA   |
| I <sub>OFF</sub>               | power-off leakage current                        | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                           | -                      | -    | ±0.2                   | μA   |
| ΔI <sub>OFF</sub>              | additional power-off leakage current             | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                  | -                      | -    | ±0.2                   | μA   |
| I <sub>CC</sub>                | supply current                                   | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -    | 0.5                    | μA   |
| ΔI <sub>CC</sub>               | additional supply current                        | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V          | <a href="#">[1]</a> -  | -    | 40                     | μA   |
| C <sub>I</sub>                 | input capacitance                                | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>                          | -                      | 0.6  | -                      | pF   |
| C <sub>O</sub>                 | output capacitance                               | V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V  | -                      | 1.3  | -                      | pF   |

**Table 7. Static characteristics ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol                                    | Parameter                            | Conditions   | Min                    | Typ | Max                    | Unit |
|---|--------------------------------------|--|------------------------|-----|------------------------|------|
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                                      |  |                        |     |                        |      |
| V <sub>IH</sub>                           | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V  | 0.70 × V <sub>CC</sub> | -   | -                      | V    |
|   |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | 0.65 × V <sub>CC</sub> | -   | -                      | V    |
|   |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.6                    | -   | -                      | V    |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | 2.0                    | -   | -                      | V    |
| V <sub>IL</sub>                           | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V  | -                      | -   | 0.30 × V <sub>CC</sub> | V    |
|   |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | -                      | -   | 0.35 × V <sub>CC</sub> | V    |
|   |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | -                      | -   | 0.7                    | V    |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | -                      | -   | 0.9                    | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage            | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|   |                                      | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V  | V <sub>CC</sub> - 0.1  | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.7 × V <sub>CC</sub>  | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 1.03                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.30                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V  | 1.97                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V  | 1.85                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V  | 2.67                   | -   | -                      | V    |
| V <sub>OL</sub>                           | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|   |                                      | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V   | -                      | -   | 0.1                    | V    |
|   |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V   | -                      | -   | 0.3 × V <sub>CC</sub>  | V    |
|   |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V   | -                      | -   | 0.37                   | V    |
|   |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V  | -                      | -   | 0.35                   | V    |
|   |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.33                   | V    |
|   |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.45                   | V    |
|   |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V   | -                      | -   | 0.33                   | V    |
| I <sub>I</sub>                            | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                    | -                      | -   | ±0.5                   | μA   |
| I <sub>OFF</sub>                          | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                           | -                      | -   | ±0.5                   | μA   |
| ΔI <sub>OFF</sub>                         | additional power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                  | -                      | -   | ±0.6                   | μA   |
| I <sub>CC</sub>                           | supply current                       | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 0.9                    | μA   |
| ΔI <sub>CC</sub>                          | additional supply current            | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V          | [1]                    | -   | 50                     | μA   |

**Table 7. Static characteristics ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol                                     | Parameter                            | Conditions   | Min                    | Typ | Max                    | Unit |
|--|--------------------------------------|--|------------------------|-----|------------------------|------|
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                                      |  |                        |     |                        |      |
| V <sub>IH</sub>                            | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V  | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
|  |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | 0.70 × V <sub>CC</sub> | -   | -                      | V    |
|  |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.6                    | -   | -                      | V    |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | 2.0                    | -   | -                      | V    |
| V <sub>IL</sub>                            | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V  | -                      | -   | 0.25 × V <sub>CC</sub> | V    |
|  |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | -                      | -   | 0.30 × V <sub>CC</sub> | V    |
|  |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | -                      | -   | 0.7                    | V    |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | -                      | -   | 0.9                    | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage            | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|  |                                      | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V  | V <sub>CC</sub> - 0.11 | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.6 × V <sub>CC</sub>  | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 0.93                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.17                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V  | 1.77                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V  | 1.67                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V  | 2.40                   | -   | -                      | V    |
| V <sub>OL</sub>                            | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|  |                                      | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V   | -                      | -   | 0.11                   | V    |
|  |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V   | -                      | -   | 0.33 × V <sub>CC</sub> | V    |
|  |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V   | -                      | -   | 0.41                   | V    |
|  |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V  | -                      | -   | 0.39                   | V    |
|  |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.36                   | V    |
|  |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.50                   | V    |
|  |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V   | -                      | -   | 0.36                   | V    |
| I <sub>I</sub>                             | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                    | -                      | -   | ±0.75                  | μA   |
| I <sub>OFF</sub>                           | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                           | -                      | -   | ±0.75                  | μA   |
| ΔI <sub>OFF</sub>                          | additional power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                  | -                      | -   | ±0.75                  | μA   |
| I <sub>CC</sub>                            | supply current                       | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 1.4                    | μA   |
| ΔI <sub>CC</sub>                           | additional supply current            | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V          | [1]                    | -   | 75                     | μA   |

[1] One input at V<sub>CC</sub> - 0.6 V, other input at V<sub>CC</sub> or GND.



## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 10](#)).

| Symbol                       | Parameter         | Conditions                               | T <sub>amb</sub> = 25 °C |                    |      | T <sub>amb</sub> = -40 °C to +125 °C |             |              |              | Unit |
|------------------------------|-------------------|--|--------------------------|--------------------|------|--------------------------------------|-------------|--------------|--------------|------|
|                              |                   |  | Min                      | Typ <sup>[1]</sup> | Max  | Min (85 °C)                          | Max (85 °C) | Min (125 °C) | Max (125 °C) |      |
| <b>C<sub>L</sub> = 5 pF</b>  |                   |  |                          |                    |      |                                      |             |              |              |      |
| t <sub>pd</sub>              | propagation delay | nCP to nQ̄; see <a href="#">Figure 8</a> | <a href="#">[2]</a>      |                    |      |                                      |             |              |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 20.9               | -    | -                                    | -           | -            | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | 2.9                      | 6.0                | 12.9 | 2.6                                  | 14.3        | 2.6          | 15.7         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | 1.9                      | 4.2                | 7.6  | 2.0                                  | 8.9         | 2.0          | 9.8          | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | 1.7                      | 3.4                | 5.9  | 1.6                                  | 7.0         | 1.6          | 7.7          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | 1.4                      | 2.6                | 4.3  | 1.2                                  | 5.6         | 1.2          | 6.2          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | 1.2                      | 2.2                | 3.6  | 1.0                                  | 4.4         | 1.0          | 4.8          | ns   |
| f <sub>max</sub>             | maximum frequency | nCP; see <a href="#">Figure 9</a>        |                          |                    |      |                                      |             |              |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 53                 | -    | -                                    | -           | -            | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | -                        | 203                | -    | 170                                  | -           | 170          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | -                        | 347                | -    | 310                                  | -           | 300          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | -                        | 435                | -    | 400                                  | -           | 390          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | -                        | 550                | -    | 490                                  | -           | 480          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | -                        | 619                | -    | 550                                  | -           | 510          | -            | MHz  |
| <b>C<sub>L</sub> = 10 pF</b> |                   |  |                          |                    |      |                                      |             |              |              |      |
| t <sub>pd</sub>              | propagation delay | nCP to nQ̄; see <a href="#">Figure 8</a> | <a href="#">[2]</a>      |                    |      |                                      |             |              |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 24.6               | -    | -                                    | -           | -            | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | 3.3                      | 6.9                | 14.9 | 3.0                                  | 16.5        | 3.0          | 18.2         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | 2.6                      | 4.8                | 8.8  | 2.3                                  | 10.3        | 2.3          | 11.3         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | 2.3                      | 3.9                | 6.8  | 2.0                                  | 8.1         | 2.0          | 8.9          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | 1.9                      | 3.1                | 5.1  | 1.7                                  | 6.3         | 1.7          | 6.9          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | 1.8                      | 2.7                | 4.4  | 1.4                                  | 4.9         | 1.4          | 5.4          | ns   |
| f <sub>max</sub>             | maximum frequency | nCP; see <a href="#">Figure 9</a>        |                          |                    |      |                                      |             |              |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 52                 | -    | -                                    | -           | -            | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | -                        | 192                | -    | 150                                  | -           | 150          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | -                        | 324                | -    | 280                                  | -           | 230          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | -                        | 421                | -    | 310                                  | -           | 250          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | -                        | 486                | -    | 370                                  | -           | 360          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | -                        | 550                | -    | 410                                  | -           | 360          | -            | MHz  |

**Table 8. Dynamic characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 10](#).)

| Symbol  | Parameter         | Conditions                               | T <sub>amb</sub> = 25 °C |                    |      | T <sub>amb</sub> = -40 °C to +125 °C |             |              |              | Unit |
|---|-------------------|--|--------------------------|--------------------|------|--------------------------------------|-------------|--------------|--------------|------|
|   |                   |  | Min                      | Typ <sup>[1]</sup> | Max  | Min (85 °C)                          | Max (85 °C) | Min (125 °C) | Max (125 °C) |      |
| <b>C<sub>L</sub> = 15 pF</b>                        |                   |  |                          |                    |      |                                      |             |              |              |      |
| t <sub>pd</sub>                                     | propagation delay | nCP to nQ̄; see <a href="#">Figure 8</a> | [2]                      |                    |      |                                      |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 28.2               | -    | -                                    | -           | -            | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | 3.0                      | 7.6                | 16.7 | 3.4                                  | 18.6        | 3.4          | 20.5         | ns   |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | 3.0                      | 5.3                | 9.8  | 2.6                                  | 11.5        | 2.6          | 12.7         | ns   |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | 2.6                      | 4.4                | 7.6  | 2.3                                  | 9.1         | 2.3          | 10.0         | ns   |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | 2.2                      | 3.5                | 5.7  | 2.0                                  | 6.9         | 2.0          | 7.6          | ns   |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | 1.9                      | 3.1                | 5.0  | 1.8                                  | 5.5         | 1.8          | 6.1          | ns   |
| f <sub>max</sub>                                    | maximum frequency | nCP; see <a href="#">Figure 9</a>        |                          |                    |      |                                      |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 50                 | -    | -                                    | -           | -            | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | -                        | 181                | -    | 120                                  | -           | 120          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | -                        | 301                | -    | 190                                  | -           | 160          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | -                        | 407                | -    | 240                                  | -           | 190          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | -                        | 422                | -    | 300                                  | -           | 270          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | -                        | 481                | -    | 320                                  | -           | 300          | -            | MHz  |
| <b>C<sub>L</sub> = 30 pF</b>                        |                   |  |                          |                    |      |                                      |             |              |              |      |
| t <sub>pd</sub>                                     | propagation delay | nCP to nQ̄; see <a href="#">Figure 8</a> | [2]                      |                    |      |                                      |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 38.8               | -    | -                                    | -           | -            | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | 4.9                      | 9.8                | 20.7 | 4.4                                  | 24.7        | 4.4          | 27.2         | ns   |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | 4.0                      | 6.8                | 12.7 | 3.5                                  | 15.0        | 3.5          | 16.5         | ns   |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | 3.5                      | 5.6                | 9.9  | 2.2                                  | 11.9        | 2.2          | 13.1         | ns   |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | 3.1                      | 4.5                | 7.5  | 2.8                                  | 9.3         | 2.8          | 10.2         | ns   |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | 2.9                      | 4.1                | 6.4  | 2.7                                  | 7.5         | 2.7          | 8.3          | ns   |
| f <sub>max</sub>                                    | maximum frequency | nCP; see <a href="#">Figure 9</a>        |                          |                    |      |                                      |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 28                 | -    | -                                    | -           | -            | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | -                        | 128                | -    | 70                                   | -           | 70           | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | -                        | 206                | -    | 120                                  | -           | 110          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | -                        | 262                | -    | 150                                  | -           | 120          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | -                        | 269                | -    | 190                                  | -           | 170          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | -                        | 309                | -    | 200                                  | -           | 190          | -            | MHz  |
| <b>C<sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF</b> |                   |  |                          |                    |      |                                      |             |              |              |      |
| t <sub>su(H)</sub>                                  | set-up time HIGH  | nD to nCP; see <a href="#">Figure 9</a>  |                          |                    |      |                                      |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                  | -                        | 2.5                | -    | -                                    | -           | -            | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V         | -                        | 0.5                | -    | 2.3                                  | -           | 2.3          | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V         | -                        | 0.3                | -    | 1.2                                  | -           | 1.2          | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V       | -                        | 0.3                | -    | 0.8                                  | -           | 0.8          | -            | ns   |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V         | -                        | 0.2                | -    | 0.6                                  | -           | 0.6          | -            | ns   |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V         | -                        | 0.2                | -    | 0.4                                  | -           | 0.4          | -            | ns   |

**Table 8. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 10](#)).

| Symbol             | Parameter                     | Conditions  | T <sub>amb</sub> = 25 °C |                    |     | T <sub>amb</sub> = -40 °C to +125 °C |             |              |              | Unit |
|--------------------|-------------------------------|---|--------------------------|--------------------|-----|--------------------------------------|-------------|--------------|--------------|------|
|                    |                               |   | Min                      | Typ <sup>[1]</sup> | Max | Min (85 °C)                          | Max (85 °C) | Min (125 °C) | Max (125 °C) |      |
| t <sub>su(L)</sub> | set-up time LOW               | nD to nCP; see <a href="#">Figure 9</a>                           |                          |                    |     |                                      |             |              |              |      |
|                    |                               | V <sub>CC</sub> = 0.8 V   | -                        | 1.7                | -   | -                                    | -           | -            | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                                  | -                        | 0.3                | -   | 1.9                                  | -           | 1.9          | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                                  | -                        | 0.2                | -   | 1.3                                  | -           | 1.3          | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                | -                        | 0.2                | -   | 1.1                                  | -           | 1.1          | -            | ns   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                  | -                        | 0.3                | -   | 0.8                                  | -           | 0.8          | -            | ns   |
| t <sub>h</sub>     | hold time                     | nD to nCP; see <a href="#">Figure 9</a>                           |                          |                    |     |                                      |             |              |              |      |
|                    |                               | V <sub>CC</sub> = 0.8 V   | -                        | -2.1               | -   | -                                    | -           | -            | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                                  | -                        | -0.4               | -   | 0.1                                  | -           | 0.1          | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                                  | -                        | -0.3               | -   | 0                                    | -           | 0            | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                | -                        | -0.2               | -   | 0                                    | -           | 0            | -            | ns   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                  | -                        | -0.2               | -   | 0                                    | -           | 0            | -            | ns   |
| t <sub>w</sub>     | pulse width                   | nCP HIGH or LOW; see <a href="#">Figure 9</a>                     |                          |                    |     |                                      |             |              |              |      |
|                    |                               | V <sub>CC</sub> = 0.8 V   | -                        | 5.2                | -   | -                                    | -           | -            | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                                  | -                        | 1.0                | -   | 3.0                                  | -           | 3.0          | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                                  | -                        | 0.8                | -   | 2.0                                  | -           | 2.0          | -            | ns   |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                | -                        | 0.6                | -   | 2.0                                  | -           | 2.0          | -            | ns   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                  | -                        | 0.5                | -   | 2.0                                  | -           | 2.0          | -            | ns   |
| C <sub>PD</sub>    | power dissipation capacitance | f = 1 MHz; V <sub>i</sub> = GND to V <sub>CC</sub> <sup>[3]</sup> |                          |                    |     |                                      |             |              |              |      |
|                    |                               | V <sub>CC</sub> = 0.8 V   | -                        | 1.8                | -   | -                                    | -           | -            | -            | pF   |
|                    |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                                  | -                        | 1.8                | -   | -                                    | -           | -            | -            | pF   |
|                    |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                                  | -                        | 1.9                | -   | -                                    | -           | -            | -            | pF   |
|                    |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                | -                        | 2.0                | -   | -                                    | -           | -            | -            | pF   |
|                    |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                  | -                        | 2.4                | -   | -                                    | -           | -            | -            | pF   |
|                    |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                  | -                        | 2.9                | -   | -                                    | -           | -            | pF           |      |

[1] All typical values are measured at nominal V<sub>CC</sub>.  
 [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.  
 [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 C<sub>L</sub> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 N = number of inputs switching;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

12. Waveforms

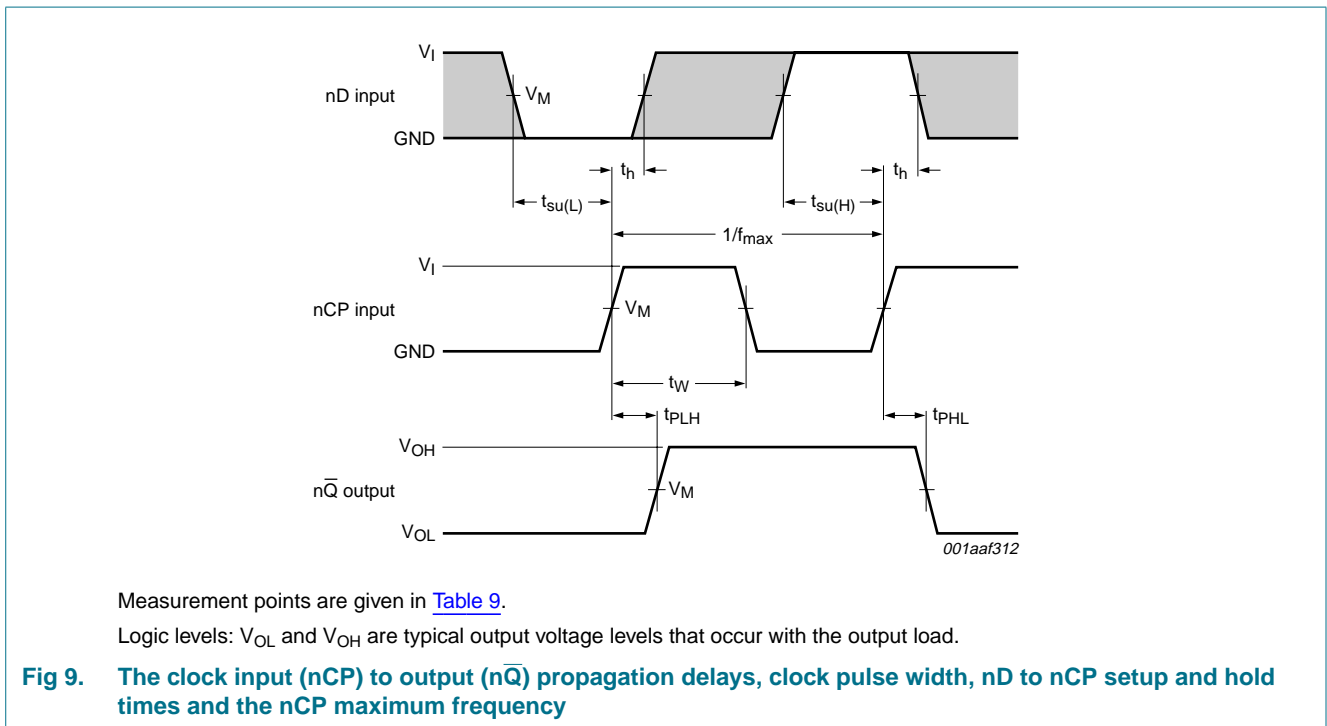
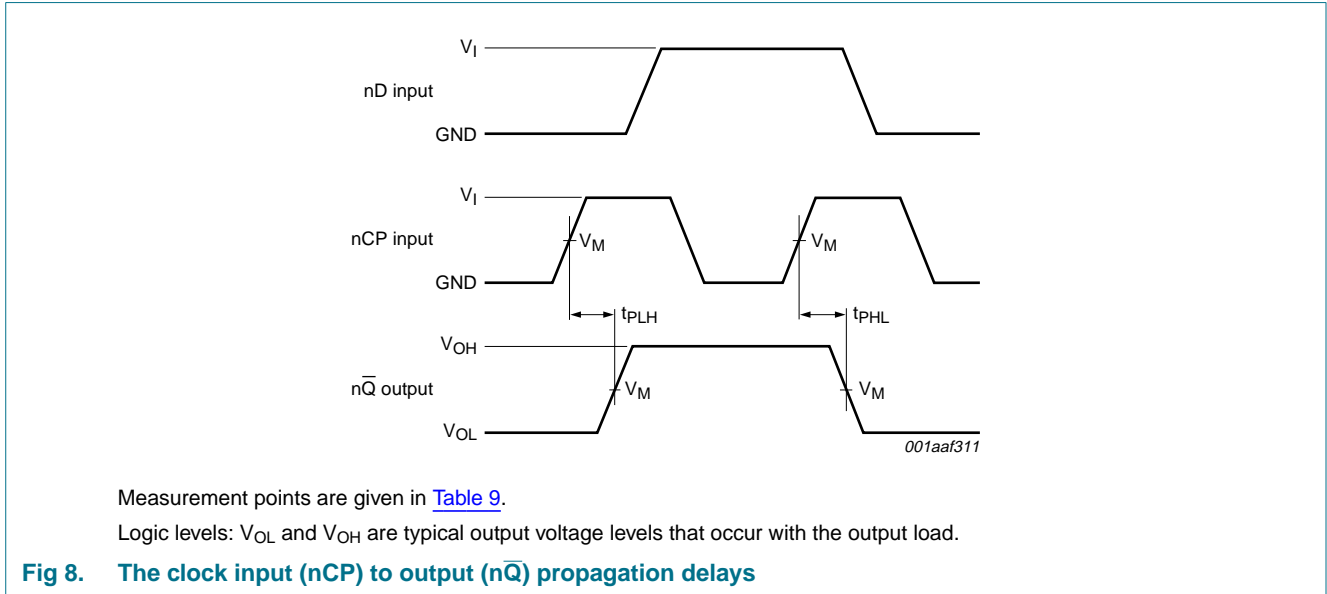
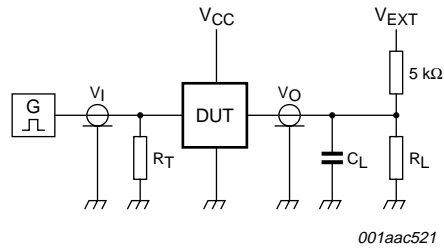


Table 9. Measurement points

| Supply voltage | Output              | Input               |          |               |
|----------------|---------------------|---------------------|----------|---------------|
| $V_{CC}$       | $V_M$               | $V_M$               | $V_I$    | $t_r = t_f$   |
| 0.8 V to 3.6 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{CC}$ | $\leq 3.0$ ns |



Test data is given in [Table 10](#).

Definitions for test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to the output impedance  $Z_o$  of the pulse generator.

$V_{EXT}$  = External voltage for measuring switching times.

**Fig 10. Load circuit for measuring switching times**

**Table 10. Test data**

| Supply voltage | Load                         |              | $V_{EXT}$          |                    |                    |
|----------------|------------------------------|--------------|--------------------|--------------------|--------------------|
| $V_{CC}$       | $C_L$                        | $R_L$ [1]    | $t_{PLH}, t_{PHL}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 0.8 V to 3.6 V | 5 pF, 10 pF, 15 pF and 30 pF | 5 kΩ or 1 MΩ | open               | GND                | $2 \times V_{CC}$  |

[1] For measuring enable and disable times  $R_L = 5 \text{ k}\Omega$

For measuring propagation delays, setup and hold times and pulse width  $R_L = 1 \text{ M}\Omega$ .

13. Package outline

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1

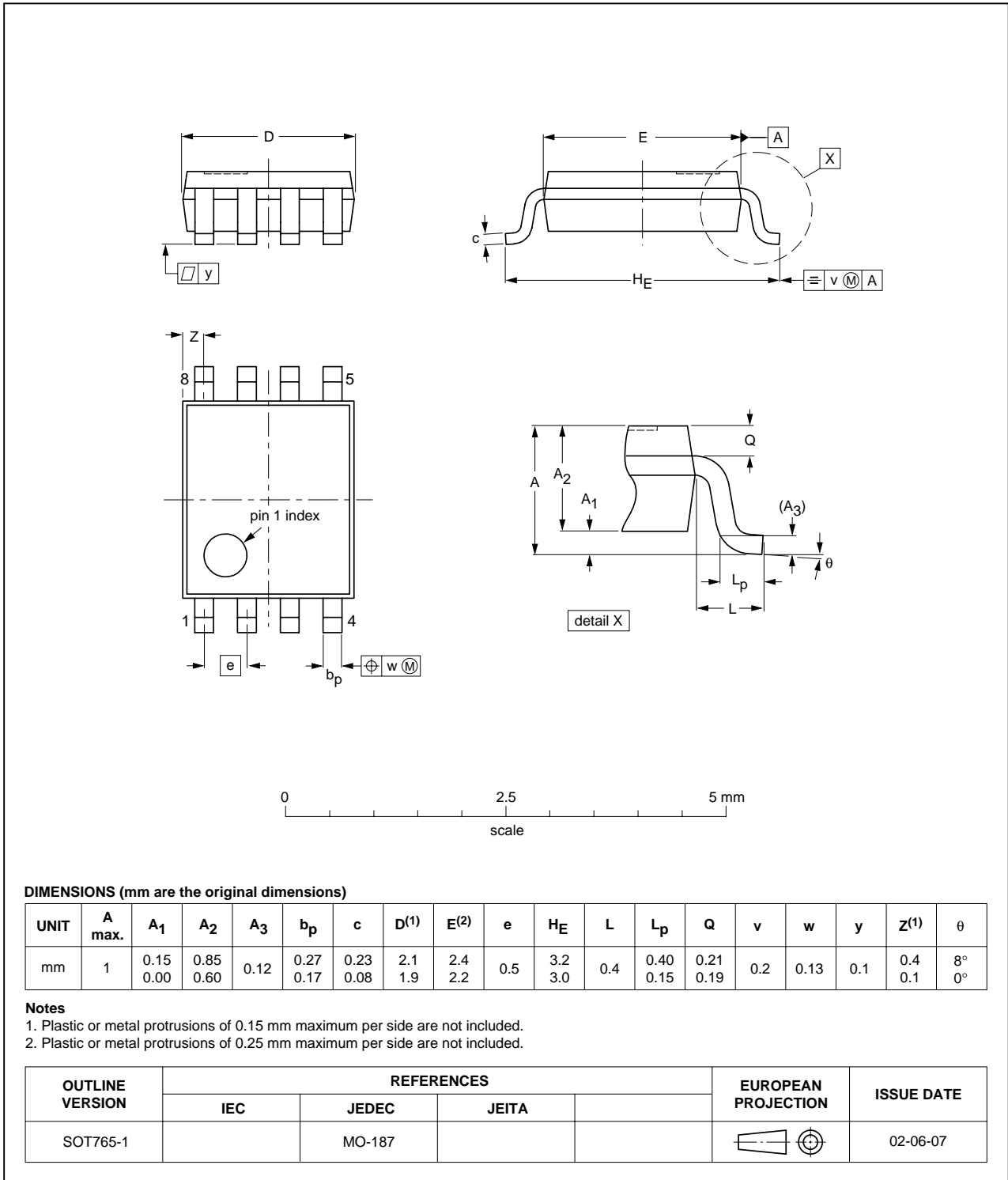


Fig 11. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

SOT833-1

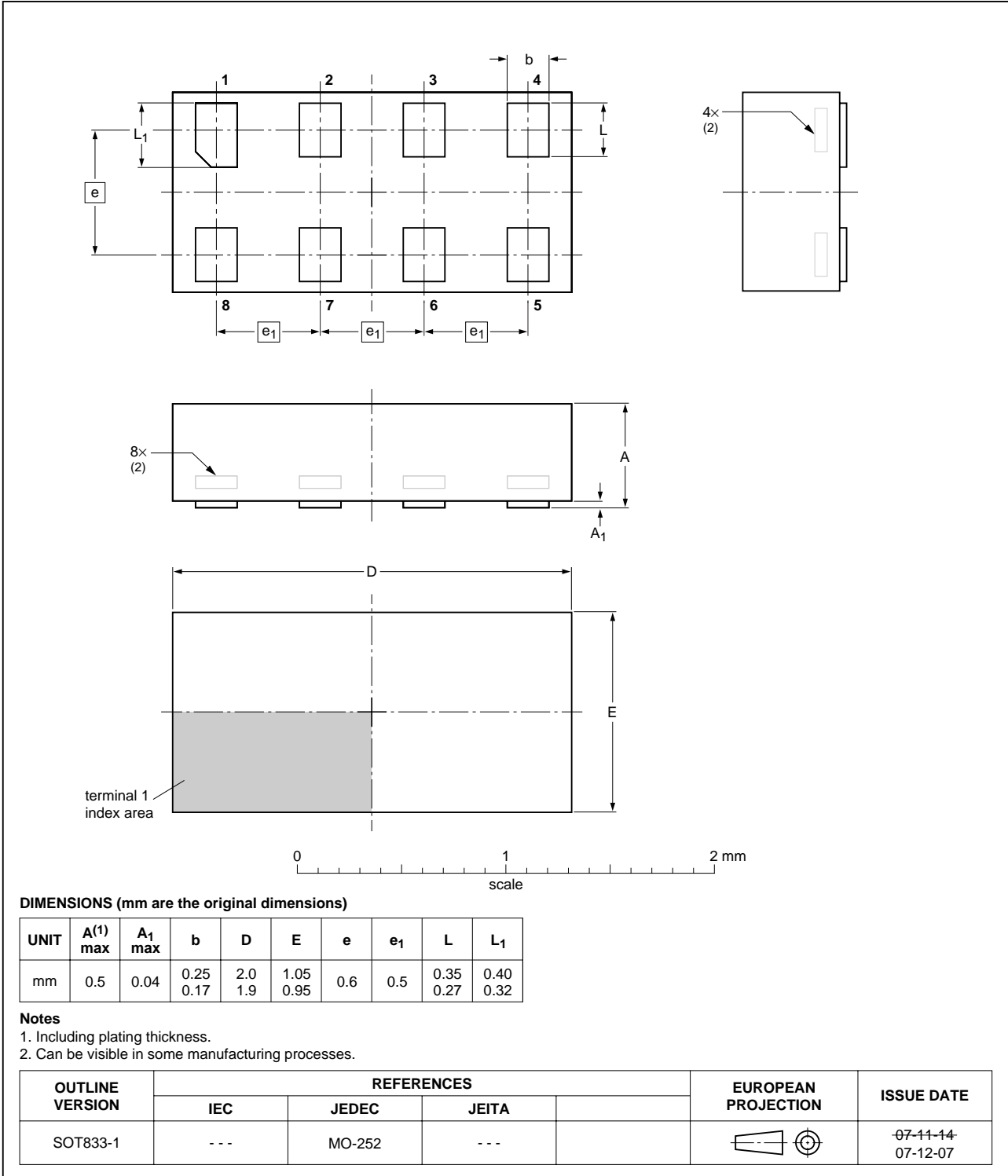


Fig 12. Package outline SOT833-1 (XSON8)

XSON8U: plastic extremely thin small outline package; no leads;  
8 terminals; UTLP based; body 3 x 2 x 0.5 mm

SOT996-2

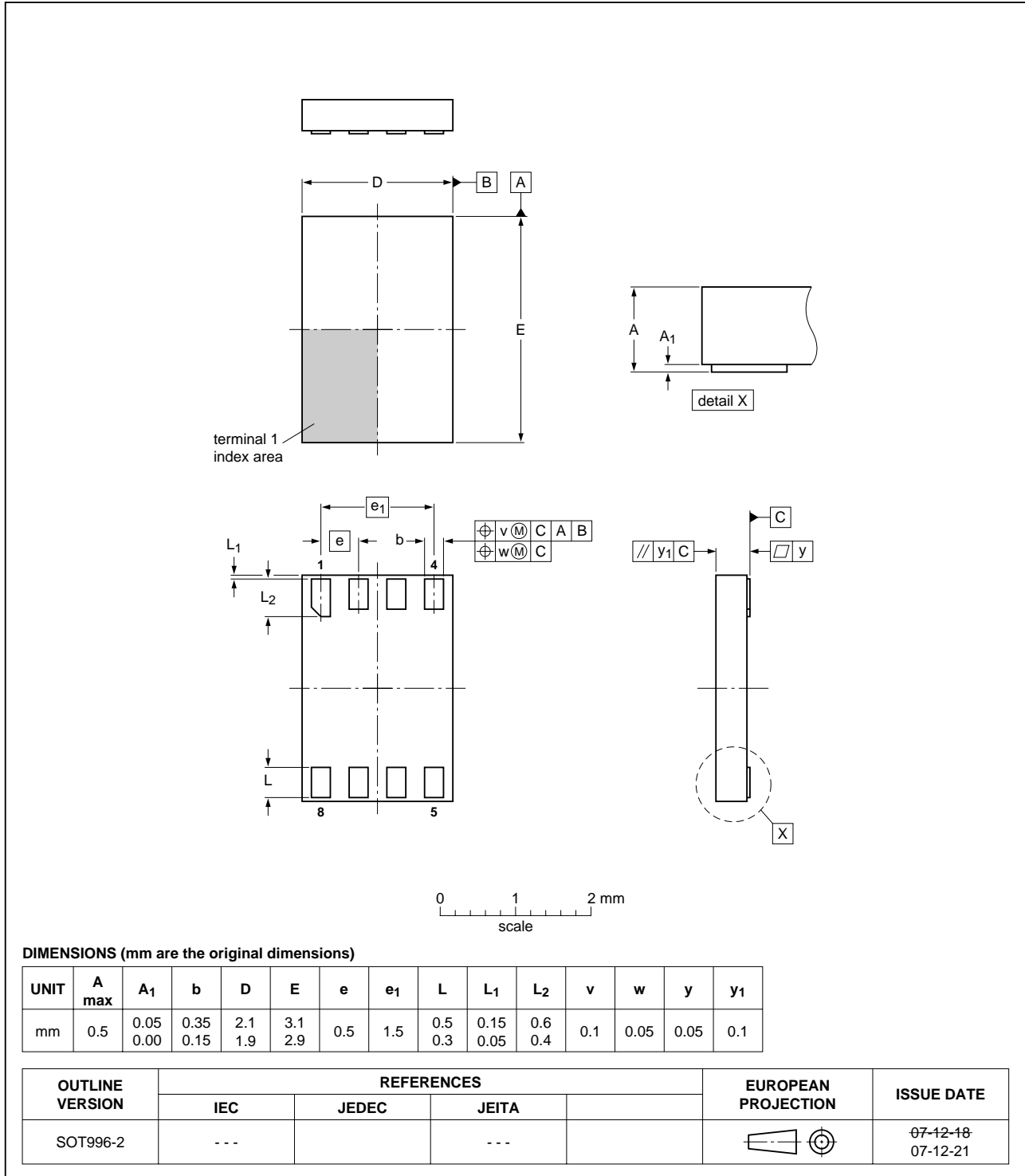
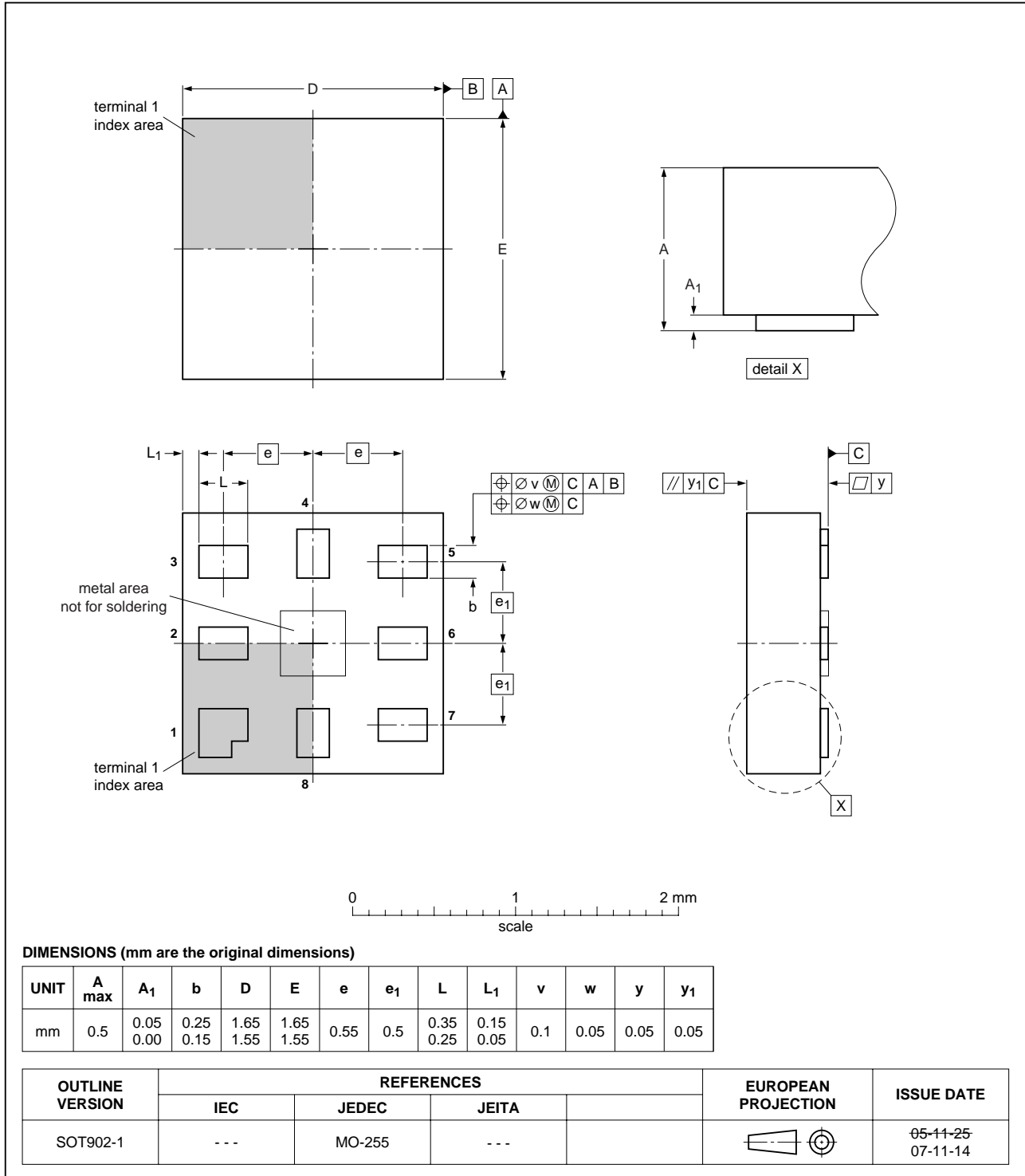


Fig 13. Package outline SOT996-2 (XSON8U)



**XQFN8U: plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 x 1.6 x 0.5 mm**

**SOT902-1**



**Fig 14. Package outline SOT902-1 (XQFN8U)**

## 14. Abbreviations

Table 11. Abbreviations

| Acronym | Description                             |
|---------|---|
| CDM     | Charged Device Model                    |
| CMOS    | Complementary Metal-Oxide Semiconductor |
| DUT     | Device Under Test                       |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| MM      | Machine Model                           |
| TTL     | Transistor-Transistor Logic             |

## 15. Revision history

Table 12. Revision history

| Document ID    | Release date   | Data sheet status  | Change notice | Supersedes  |
|----------------|--|--------------------|---------------|-------------|
| 74AUP2G80_4    | 20080602   | Product data sheet | -             | 74AUP2G80_3 |
| Modifications: | <ul style="list-style-type: none"> <li>Added type number 74AUP2G80GD (XSON8U package)</li> </ul> |                    |               |             |
| 74AUP2G80_3    | 20080328   | Product data sheet | -             | 74AUP2G80_2 |
| 74AUP2G80_2    | 20070801   | Product data sheet | -             | 74AUP2G80_1 |
| 74AUP2G80_1    | 20060825   | Product data sheet | -             | -           |

## 16. Legal information

### 16.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition  |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
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